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(71) 出願人 000005290

古河電気工業株式会社

東京都千代田区丸の内2丁目6番1号

(72) 発明者 枝 義弥

東京都千代田区丸の内2丁目6番1号 古

河電気工業株式会社内

(72) 発明者 上野 誠三

東京都千代田区丸の内2丁目6番1号 古

河電気工業株式会社内

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5F036 AA01 BB01 BB05 BC33

(54) 【発明の名称】 かしめ型ヒートシンク

(57) 【要約】

【課題】 かしめ作業性に優れ且つかしめ状態が良好な、特に電子機器の冷却に適したかしめ型ヒートシンクを提供する。

【解決手段】 基板1上に断面角型の突起部2が、複数本、平行に設けられ、前記突起部2の長さ方向に溝(幅W、深さB)3が設けられ、溝3に板状フィン(厚さt)4の基部が挿入され、板状フィン4の基部が突起部2を構成する突起部片(幅A)8を溝3側に押圧することによりかしめられており、且つ、かしめ前の基板1および板状フィン4が下記(a)~(c)の関係式を満足することを特徴とするかしめ型ヒートシンク。

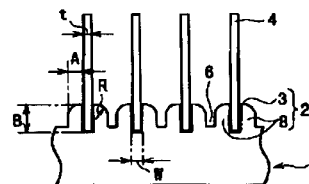
0. $8 \geq (A/B) \geq 0.4$ (a)

2. $0 \geq (R/A) \geq 0.3$ (b)

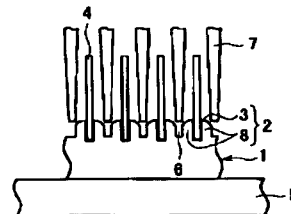
0. $4 \geq (W-t)/t \geq 0.05$ (c)

但し、Rは突起部片8の反溝3側の円弧状角部の半径。

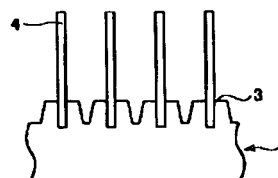
(イ)



(ロ)



(ハ)



【特許請求の範囲】

【請求項1】 基板上に断面角型の突起部が、複数本、平行に設けられ、前記突起部の長さ方向に溝（幅W、深さB）が設けられ、前記溝に板状フィン（厚さt）の基部が挿入され、前記板状フィンの基部が前記突起部を構成する突起部片（幅A）を溝側に押圧することによりかしめられているかしめ型ヒートシンクにおいて、かしめ前の基板および板状フィンが下記（a）～（c）の関係式を満足することを特徴とするかしめ型ヒートシンク。

$$0.8 \geq (A/B) \geq 0.4 \dots\dots (a)$$

$$2.0 \geq (R/A) \geq 0.3 \dots\dots (b)$$

$$0.4 \geq (W-t)/t \geq 0.05 \dots\dots (c)$$

但し、Rは突起部片の反溝側の円弧状角部の半径。

【発明の詳細な説明】

【0001】

【発明の属する技術分野】本発明は、かしめ作業性に優れ、且つかしめ状態が良好な、特に電子機器の冷却に適したかしめ型ヒートシンクに関する。

【0002】

【従来の技術】ヒートシンクは、図2に示すように、基板1上に板状フィン4を接合したもので、接合方法には、かしめによるもの（かしめ型ヒートシンク）、ろう付けによるもの、基板と板状フィンを一体に押出成形して接合したものなどが知られているが、特にかしめ型ヒートシンクは安価であり最も普及している。

【0003】かしめ型ヒートシンクは、例えば、図3（イ）、（ロ）に示すように、基板1上に断面角型の突起部2を、複数本、平行に設け、この突起部2に突起部2の長さ方向に平行に溝3を設け、溝3の各々に板状フィン4の基部を挿入し、突起部2間のかしめ用溝6に押圧具（図示せず）の先端部を押し込んで、前記突起部2を構成する突起部片8を溝3側に押圧して板状フィン4の基部を溝3内にかしめたものである。

【0004】

【発明が解決しようとする課題】しかし、前記従来のかしめ型ヒートシンクは、かしめ状態が不良なため所望の放熱特性が得られなかったり、ごく稀ではあるが輸送中の振動や衝撃により板状フィンが抜け落ちたりすることがあった。またかしめ用溝への押圧具の押し込み作業性が悪かった。本発明者等は、このような状況に鑑み、かしめ型ヒートシンクについて種々検討し、基板に設ける溝部分の形状や寸法などを適正に設定することにより、かしめ状態やかしめ作業性を改善し得ることを知見し、さらに検討を重ねて本発明を完成させるに至った。本発明は、かしめ状態が良好で、且つかしめ作業性に優れ、特に電子機器の冷却に適したかしめ型ヒートシンクの提供を目的とする。

【0005】

【課題を解決するための手段】請求項1記載の発明は、基板上に断面角型の突起部が、複数本、平行に設けら

れ、前記突起部の長さ方向に溝（幅W、深さB）が設けられ、前記溝に板状フィン（厚さt）の基部が挿入され、前記板状フィンの基部が前記突起部を構成する突起部片（幅A）を溝側に押圧することによりかしめられているかしめ型ヒートシンクにおいて、かしめ前の基板および板状フィンが下記（a）～（c）の関係式を満足することを特徴とするかしめ型ヒートシンクである。

$$0.8 \geq (A/B) \geq 0.4 \dots\dots (a)$$

$$2.0 \geq (R/A) \geq 0.3 \dots\dots (b)$$

$$0.4 \geq (W-t)/t \geq 0.05 \dots\dots (c)$$

但し、Rは突起部片の反溝側の円弧状角部の半径。

【0006】

【発明の実施の形態】本発明は、基板上に設けられた突起部片の幅Aと溝深さBの比（A/B）、突起部片の反溝側の円弧状角部の半径Rと突起部片の幅Aの比（R/A）および溝幅Wと板状フィンの厚さtとの関係（W-t）/tを適正に規定することにより、板状フィンのかしめ状態およびかしめ作業性を改善したものである。

【0007】本発明において、前記（A/B）を0.8

以下0.4以上に規定する理由は、Aが大きく（厚く）て（A/B）が0.8を超える場合はかしめに多大の労力を要しかしめ作業性が悪化するためであり、Bが小さく（浅く）て（A/B）が0.8を超える場合は十分なかしめ力が得られないためである。またAが小さく（薄く）て（A/B）が0.4未満になる場合は十分なかしめ力が得られないためであり、Bが大きく（深く）て（A/B）が0.4未満になる場合は溝内面と板状フィンとの有効な接触面積（放熱特性）が飽和するうえ、基板（押出材）の溝加工が困難になるためである。

【0008】本発明において、前記（R/A）を2.0以下0.3以上に規定する理由は、曲率半径Rが大きくて（R/A）が2.0を超える場合はかしめ具が突起部片の下方で接触するため突起部片を溝側に押圧するのが困難になるためであり、Aが小さく（薄く）て（R/A）が2.0を超える場合は突起部片によるかしめ力が十分に得られないためである。また曲率半径Rが小さくて（R/A）が0.3未満となる場合は、かしめ具をかしめ溝に押込む際にかしめ具が突起部片にぶつかり易くなるためであり、Aが大きく（厚く）て（R/A）が0.3未満となる場合は突起部片を溝側に押圧するのに多大の労力を要するためである。

【0009】本発明において、前記（W-t）/tを0.4以下0.05以上に規定する理由は、0.4を超えると板状フィンと溝内面との間隙が大きすぎて双方の密着性が劣り、0.05未満では板状フィンと溝内面との間隙が小さすぎて板状フィンを溝内に挿入し難くなるためである。

【0010】本発明において、基板上の突起部に設ける溝の幅W、深さB、前記突起部を構成する突起部片の幅A並びに板状フィンの厚さtの寸法は、通常使用されて

いるかしめ型ヒートシンクのそれに近似したものであり、その近似した寸法の中で、 (A/B) 、 (R/A) 、 $((W-t)/t)$ などの比を規定したものである。

【0011】

【実施例】以下に、本発明を実施例により詳細に説明する。

(実施例1) 図1(イ)に示すように、基板1の上面に断面角型の突起部2を、27個、平行に設け、各突起部2にはその長さ方向にそれぞれ溝3を設け、溝3の各々に板状フィン4の基部を挿入し、次いで図1(ロ)に示すように、基板1を受け板5上に載せ、基板1上面の突起部2間のかしめ用溝6に押圧具7の先端部を押込んで突起部片8を溝3側に押圧して板状フィン4を溝3内にかしめて、図1(ハ)に示すかしめ型ヒートシンクを製造した。基板には幅120mm、長さ200mm、厚さ10mmのアルミニウム合金押出形材を用いた。板状フィンには幅120mm、高さ(溝内部分を含む)100mm、厚さtmmのアルミニウム合金板を用いた(図2参照)。図1(イ)に示した、かしめ前の基板の溝幅W、溝深さB、突起部片の幅A、突起部片の反溝側の円*

* 弧状角部の半径R、および板状フィンの厚さtは、表1に示すように、本発明で規定する関係式(a)~(c)を満足する範囲で種々に変化させた。

【0012】(比較例1) かしめ前の基板の溝幅W、溝深さB、突起部片の幅A、突起部片の反溝側の円弧状角部の半径R、および板状フィンの厚さtを表1に示すように、前記関係式(a)~(c)を満足しない範囲で種々に変化させた他は、実施例1と同じ方法によりかしめ型ヒートシンクを製造した。

【0013】実施例1および比較例1で製造した各々のかしめ型ヒートシンクについて、かしめ作業性およびかしめ状態を調べた。かしめ作業性については(1)溝への板状フィンの挿入性、(2)かしめ溝への押圧具の挿入性、(3)かしめ溝への押圧具の押込力(かしめ荷重)を調べ評価した。かしめ状態については(4)溝内面と板状フィンとの隙間の有無、(5)溝から板状フィンを引抜く際の引抜力を調べ評価した。調査および評価結果を表2に示す。

【0014】

【表1】

分類	試料No	基板寸法 mm				フィン寸法 t mm	A/B	R/A	(W-t)/t
		A	B	R	W				
本発明例	1	1.20	2.00	1.00	0.95	0.80	0.60	0.83	0.19
	2	0.90	2.00	1.00	0.90	0.80	0.45	1.11	0.13
	3	1.20	1.80	1.00	0.90	0.80	0.67	0.83	0.13
	4	1.20	2.20	1.00	0.90	0.80	0.55	0.83	0.13
	5	1.20	2.00	0.50	0.95	0.80	0.60	0.42	0.13
	6	1.20	2.00	1.50	0.90	0.80	0.60	1.25	0.13
	7	1.20	2.00	1.00	0.85	0.80	0.60	0.83	0.06
	8	1.20	2.00	1.00	1.05	0.80	0.60	0.83	0.31
	9	1.20	2.00	1.00	0.90	0.70	0.60	0.83	0.29
比較例	10	0.90	3.00	1.00	0.90	0.80	0.30	1.11	0.13
	11	2.00	2.00	0.20	0.90	0.80	1.00	0.10	0.13
	12	1.20	2.00	0.20	0.90	0.80	0.60	0.17	0.13
	13	1.20	2.00	4.00	1.30	0.80	0.60	3.33	0.63
	14	1.20	2.00	1.00	0.90	0.50	0.60	0.83	0.80

【0015】

【表2】

分類	試料 No.	(1)フィン の挿入性	(2)押圧 具の挿入性	(3)かし め荷重 KN	(4)溝と フィン の隙間	(5)フィン の引抜 力N/cm	備 考
本発明例	1	○	○	15	無	650	
	2	○	○	13	無	500	
	3	○	○	15	無	500	
	4	○	○	14	無	600	
	5	○	○	16	無	500	
	6	○	○	12	無	500	
	7	○	○	14	無	550	
	8	○	○	12	無	500	
	9	○	○	13	無	500	
比較例	10	○	○	13	無	500	基板の押出成形困難
	11	○	×	20	無	550	
	12	○	×	19	無	500	
	13	○	○	18	有	190	
	14	○	○	19	有	150	

(註) (1)～(3)はかしめ作業性を示す。
(4)、(5)はかしめ状態を示す。

【0016】表2より明らかなように、本発明例品のNo. 1～9は、いずれも前記(1)～(5)を満足し、かしめ作業性およびかしめ状態に優れるものであった。これに対し、比較例のNo. 10は溝が深すぎて(A/B)が本発明規定値未満となり、本発明例のNo. 2と比較べてかしめ状態が飽和しており、しかも、溝が深いため基板の押出成形が困難であった。No. 11はAが厚すぎたため(A/B)が本発明規定値を超えかしめ荷重が増大し、またRが小さかったため(R/A)が本発明規定値未満となり押圧具の挿入性が劣った。No. 12はRが小さかったため(R/A)が本発明規定値未満となり押圧具の挿入性が劣った。No. 13はRが大きすぎたため(R/A)が本発明規定値を超え、またwが大きすぎたため(w-t)/tが本発明規定値を超え、かしめ状態が劣った。No. 14はtが小さいため(w-t)/tが本発明規定値を超え、かしめ状態が劣った。

【0017】前記実施例(本発明例)では、基板溝への板状フィンの挿入およびかしめを常温で高速度で行ったが、何のトラブルも起きなかった。本発明では、基板の溝内に、予め、熱伝導性接着剤を入れておくと、基板と板状フィン間の熱伝達性が向上し、より放熱特性に優れたかしめ型ヒートシンクが得られる。

【0018】

【発明の効果】以上に述べたように、本発明のかしめ型ヒートシンクは、基板上に設けられた突起部を構成する

突起部片の幅Aと溝深さBの比(A/B)、突起部片の反溝側の円弧状角部の半径Rと突起部片の幅Aの比(R/A)、および溝幅Wと板状フィンの厚さtとの関係(W-t)/tを適正に規定したもので、板状フィンのかしめ作業性およびかしめ状態に優れ、工業上顕著な効果を奏する。

【図面の簡単な説明】

【図1】本発明のかしめ型ヒートシンクの実施形態を示す、(イ)はかしめ前の横断面説明図、(ロ)はかしめ作業時の横断面説明図、(ハ)はかしめ後の横断面説明図である。

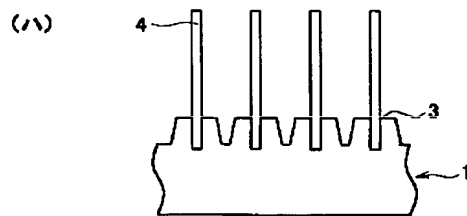
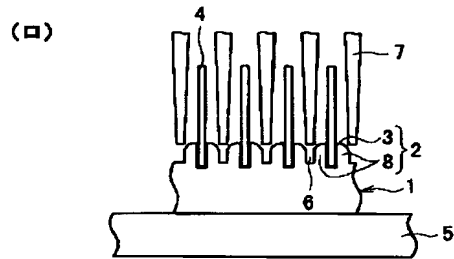
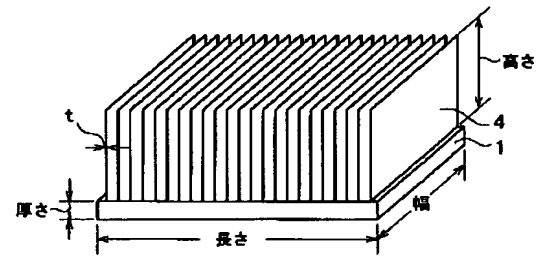
【図2】ヒートシンクの斜視説明図である。

【図3】(イ)は従来のかしめ型ヒートシンクのかしめ前の平面説明図、(ロ)は図(イ)のa-a矢視図である。

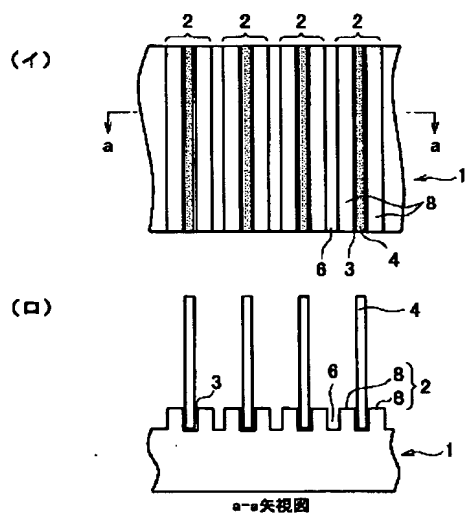
【符号の説明】

- 1 基板
- 2 突起部
- 3 溝
- 4 板状フィン
- 5 受け板
- 6 かしめ用溝
- 7 押圧具
- 8 突起部片

【図2】



【図 3】



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Bibliography.

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(51) [The 7th edition of International Patent Classification]

H05K 7/20
H01L 23/36

[FI]

H05K 7/20 B
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(71) [Applicant]
[Identification Number] 000005290.
[Name] The Furukawa Electric Co., Ltd.
[Address] 2-6-1, Marunouchi, Chiyoda-ku, Tokyo.
(72) [Inventor(s)]
[Name] Branch Yoshiya.
[Address] 2-6-1, Marunouchi, Chiyoda-ku, Tokyo Inside of the Furukawa Electric Co., Ltd.
(72) [Inventor(s)]
[Name] Ueno Sincerity 3.
[Address] 2-6-1, Marunouchi, Chiyoda-ku, Tokyo Inside of the Furukawa Electric Co., Ltd.
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Summary.

(57) [Abstract]

[Technical problem] It excels in caulking workability and a caulking state offers the good staking-die heat sink suitable for especially cooling of electronic equipment.

[Means for Solution] The piece 8 of a height (width of face A) from which two or more heights 2 of a cross-section square shape are formed in parallel on a substrate 1, a slot (width of face W, depth B) 3 is formed in the length direction of the aforementioned height 2, the base of the tabular fin (thickness t) 4 is inserted in a slot 3, and the base of the tabular fin 4 constitutes a height 2 is pressed to a slot 3 side. The staking-die heat sink characterized by the substrate 1 and the tabular fin 4 before a caulking **** cage and a caulking satisfying the relational expression of following (a) - (c).

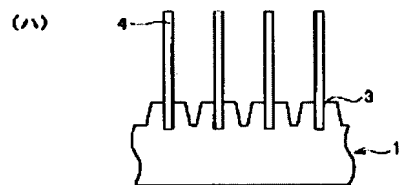
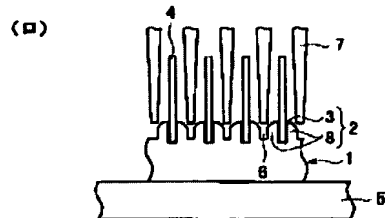
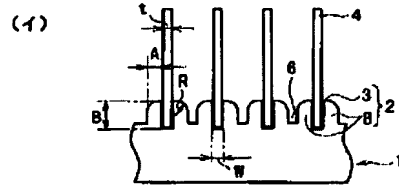
$0.8 \geq (A/B) \geq 0.4$ (a)

$2.0 \geq (R/A) \geq 0.3$ (b)

$0.4 \geq (W-t) / t \geq 0.05$ (c)

However, R is the radius of the circular corner by the side of the anti-slot 3 of the piece 8 of a height.

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CLAIMS

[Claim(s)]

[Claim 1] the height of a cross-section square shape prepares two or more in parallel on a substrate -- having -- the length direction of the aforementioned height -- a slot (width of face W --) In the staking-die heat sink with which or is closed more to press the piece of a height (width of face A) from which depth B is prepared, the base of a tabular fin (thickness t) is inserted in the aforementioned slot, and the base of the aforementioned tabular fin constitutes the aforementioned height to a slot side The staking-die heat sink characterized by the substrate and tabular fin before a caulking satisfying the relational expression of following (a) - (c).

$$0.8 \geq (A/B) \geq 0.4 \dots\dots (a)$$

$$2.0 \geq (R/A) \geq 0.3 \dots\dots (b)$$

$$0.4 \geq (W-t) / t \geq 0.05 \dots\dots (c)$$

However, R is the radius of the circular corner by the side of the anti-slot of the piece of a height.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[The technical field to which invention belongs] this invention is excellent in caulking workability, and a caulking state is related with the good staking-die heat sink suitable for especially cooling of electronic equipment.

[0002]

[Description of the Prior Art] Although what a heat sink is what joined the tabular fin 4 on the substrate 1 as shown in drawing 2, carried out extrusion molding of what is depended on a caulking at the junction method (staking-die heat sink), the thing to depend on soldering, a substrate, and the tabular fin to one, and was joined is known, especially the staking-die heat sink is cheap, and has spread most.

[0003] As a staking-die heat sink is shown in for example, the drawing 3 (b) and a (b) On a substrate 1, form two or more heights 2 of a cross-section square shape in parallel, and a slot 3 is formed in the length direction of a height 2 in parallel at this height 2. The base of the tabular fin 4 is inserted in each of a slot 3, the point of a press implement (not shown) is stuffed into the slot 6 for caulking between heights 2, the piece 8 of a height which constitutes the aforementioned height 2 is pressed to a slot 3 side, and the base of the tabular fin 4 is closed in a slot 3.

[0004]

[Problem(s) to be Solved by the Invention] However, although you made it go away conventionally and the mold heat sink had [aforementioned] the very rare caulking state in not acquiring the thermolysis property of a poor hatchet request, the tabular fin might fall out by the vibration under transportation, or the shock. Moreover, the indentation workability of the press implement to the slot for caulking was bad. By examining many things about a staking-die heat sink, and setting up a configuration, a size, etc. for a slot which are prepared in a substrate proper in view of such a situation, this invention person etc. does the knowledge of the ability to improve a caulking state and caulking workability, and came to complete this invention for examination in piles further. The caulking state of this invention is good, and it excels in caulking workability, and aims at offer of the staking-die heat sink suitable for especially cooling of electronic equipment.

[0005]

[Means for Solving the Problem] As for invention according to claim 1, two or more heights of a cross-section square shape are prepared in parallel on a substrate. A slot (width of face W, depth B) is prepared in the length direction of the aforementioned height, and the base of a tabular fin (thickness t) is inserted in the aforementioned slot. In the staking-die heat sink with which or is closed more to press the piece of a height (width of face A) from which the base of the aforementioned tabular fin constitutes the aforementioned height to a slot side The substrate and tabular fin before a caulking are the staking-die heat sink characterized by

satisfying the relational expression of following (a) - (c).

$0.8 \geq (A/B) \geq 0.4$ (a)

$2.0 \geq (R/A) \geq 0.3$ (b)

$0.4 \geq (W-t) / t \geq 0.05$ (c)

However, R is the radius of the circular corner by the side of the anti-slot of the piece of a height.

[0006]

[Embodiments of the Invention] this invention improves the caulking state and caulking workability of a tabular fin by specifying the relation $(W-t)/t$ of the ratio (R/A) of the width of face A of the piece of a height prepared on the substrate, the radius R of the circular corner by the side of the ratio (A/B) of channel-depth B, and the anti-slot of the piece of a height, and the width of face A of the piece of a height, and a flute width W and thickness t of a tabular fin proper.

[0007] in this invention, the reason for specifying the above (A/B) or more [0.8 or less] to 0.4 is for a caulking to take a great effort to (A/B) , when A exceeds 0.8 greatly (thickly), and for caulking workability to get worse, and when B exceeds 0.8, (A/B) is small (shallowly) enough — it is because the inside bundle force is not acquired moreover, when A becomes less than 0.4, (A/B) is small (thinly) enough — it is because the inside bundle force is not acquired, and when (A/B) becomes [B] less than 0.4 greatly (deeply), in saturating the effective touch area (thermolysis property) of a slot inside and a tabular fin, it is because recessing of a substrate (extruded section) becomes difficult

[0008] In this invention, the reason for specifying the above (R/A) or more [2.0 or less] to 0.3 It is because it becomes difficult to press the piece of a height to a slot side in order that a caulking implement may contact in the lower part of the piece of a height, when exceeding 2.0. radius of curvature R — being large (R/A) — When (R/A) exceeds [A] 2.0 small (thinly), it is because the caulking force by the piece of a height is not fully acquired. moreover, the radius of curvature R — being small (R/A) — when becoming less than 0.3, in case a caulking implement is stuffed into a caulking slot, it is for a caulking implement to become easy to collide with the piece of a height, and A is for (R/A) to take a great effort greatly (thickly) to press the piece of a height to a slot side, when becoming less than 0.3

[0009] In this invention, when 0.4 is exceeded, the reason for specifying the aforementioned $(W-t) / t$ or more [0.4 or less] to 0.05 has the too large gap of a tabular fin and a slot inside, both adhesion is inferior in it, and it is because the gap of a tabular fin and a slot inside is too small and stops being able to insert a tabular fin in Mizouchi easily less than in 0.05.

[0010] In this invention, the width of face A of the piece of a height which constitutes the width of face W of the slot established in the height on a substrate, depth B, and the aforementioned height, and the size of thickness t of a tabular fin are approximated to it of the staking-die heat sink usually used, and specify ratios $(W-t) / t$, such as (A/B) and (R/A) , in the approximated size.

[0011]

[Example] Below, an example explains this invention in detail.

As shown in the drawing 1 (b), on the upper surface of a substrate 1 (Example 1) The height 2 of a cross-section square shape So that may prepare in parallel, a slot 3 may be formed in the length direction 27 pieces at each height 2, respectively, the base of the tabular fin 4 may be inserted in each of a slot 3 and it may be shown subsequently to the drawing 1 (b) The substrate 1 was carried on the wear plate 5, and the staking-die heat sink which stuffs the point of the press implement 7 into the slot 6 for caulking between the heights 2 of the substrate 1 upper surface, presses the piece 8 of a height to a slot 3 side, and shows the tabular fin 4 in total in a slot 3 at the drawing 1 (c) was manufactured. The aluminium alloy extruded section with width of face of 120mm, a length [of 200mm], and a thickness of 10mm was used for the substrate. The aluminium alloy board of width of face of 120mm, a height (a part for the interior of a slot is included) of 100mm, and thickness tmm was used for the tabular fin (refer to drawing 2). drawing 1 — (**) — having been shown — a caulking — a front — a substrate — a flute width — W — a channel depth — B — a height — a piece — width of face — A — a height — a piece —

anti- -- a slot -- a side -- circular -- a corner -- a radius -- R -- and -- a tabular -- a fin -- thickness -- t -- a table -- one -- being shown -- as -- this invention -- specifying -- relational expression -- (-- a --) -- -- -- (--

[0012] (Example 1 of comparison) as shown in Table 1, in the range with which are not satisfied of aforementioned relational-expression (a) - (c), boiled variously the radius R of the circular corner by the side of the width of face A of the flute width W of the substrate before a caulking, channel-depth B, and the piece of a height, and the anti-slot of the piece of a height, and thickness t of a tabular fin, and they were changed, and also the staking-die heat sink was manufactured by the same method as a

[0013] Caulking workability and the caulking state were investigated about each staking-die heat sink manufactured in the example 1 and the example 1 of comparison. About caulking workability, the pushing force (caulking load) of the insertion nature of the tabular fin to (1) slot, the insertion nature of the press implement to (2) caulking slots, and the press implement to (3) caulking slots was investigated and evaluated. About the caulking state, the drawing force at the time of drawing out a tabular fin was investigated and evaluated from the existence of the crevice between (4) slot inside and a tabular fin, and (5) slots. Investigation and an evaluation result are shown in Table 2.

[0014]

[Table 1]

分類	試料 No	基板寸法 mm				フィン 寸法 t mm	A/B	R/A	(W-t)/t
		A	B	R	W				
本発明例	1	1.20	2.00	1.00	0.95	0.80	0.50	0.83	0.19
	2	0.90	2.00	1.00	0.90	0.80	0.45	1.11	0.13
	3	1.20	1.80	1.00	0.90	0.80	0.67	0.83	0.13
	4	1.20	2.20	1.00	0.90	0.80	0.55	0.83	0.13
	5	1.20	2.00	0.50	0.95	0.80	0.60	0.42	0.13
	6	1.20	2.00	1.50	0.90	0.80	0.60	1.25	0.13
	7	1.20	2.00	1.00	0.85	0.80	0.60	0.83	0.06
	8	1.20	2.00	1.00	1.05	0.80	0.60	0.83	0.31
	9	1.20	2.00	1.00	0.80	0.70	0.60	0.83	0.29
比較例	10	0.90	3.00	1.00	0.80	0.80	0.30	1.11	0.13
	11	2.00	2.00	0.20	0.90	0.80	1.00	0.10	0.13
	12	1.20	2.00	0.20	0.90	0.80	0.60	0.17	0.13
	13	1.20	2.00	4.00	1.30	0.80	0.60	3.33	0.63
	14	1.20	2.00	1.00	0.90	0.50	0.60	0.83	0.80

[0015]

[Table 2]

分類	試料 No.	(1)フィン の挿入性	(2)押圧 具の挿入性	(3)かし め荷重 K N	(4)溝と フィン の隙間	(5)フィ ンの引抜 力N/cm	備 考
本発明例	1	○	○	15	無	650	
	2	○	○	13	無	500	
	3	○	○	15	無	500	
	4	○	○	14	無	600	
	5	○	○	16	無	500	
	6	○	○	12	無	500	
	7	○	○	14	無	550	
	8	○	○	12	無	500	
	9	○	○	13	無	500	
比較例	10	○	○	13	無	500	基板の押出成形困難
	11	○	×	20	無	550	
	12	○	×	19	無	500	
	13	○	○	18	有	190	
	14	○	○	19	有	150	

(註) (1)～(3)はかしめ作業性を示す。
(4)、(5)はかしめ状態を示す。

[0016] Each No.1-9 of the example article of this invention was what satisfies aforementioned (1) - (5) and is excellent in caulking workability and a caulking state so that more clearly than Table 2. On the other hand, the slot became [too (A/B)] deep under this invention default value, the caulking state was saturated compared with No.2 of the example of this invention, and, moreover, for the Fukai reason, No.10 of the example of comparison had extrusion molding of a substrate difficult for the slot. Since A was too thick (A/B), this invention default value was exceeded, the caulking load increased, and since it was small (R/A), R became under this invention default value, and No.11 were inferior in the insertion nature of a press implement. Since it was small (R/A), R became under this invention default value, and No.12 were inferior in the insertion nature of a press implement. Since R was too large (R/A), this invention default value was exceeded, and since w was too large (w-t), /t exceeded this invention default value, and No.13 were inferior in the caulking state. Since it was small (w-t), /t exceeded [t] this invention default value, and No.14 were inferior in the caulking state.

[0017] In the aforementioned example (example of this invention), although insertion of the tabular fin to a substrate slot and the caulking were performed at high speed in ordinary temperature, no trouble occurred. In this invention, if thermally conductive adhesives are beforehand put into Mizouchi of a substrate, the heat transfer nature between a substrate and a tabular fin will improve, and the staking-die heat sink which is more excellent in a thermolysis property will be obtained.

[0018]

[Effect of the Invention] As stated above, the staking-die heat sink of this invention The width of face A of the piece of a height and the ratio of channel-depth B (A/B) which constitute the height prepared on the substrate, It is the ratio (R/A) of the radius R of the circular corner by the side of the anti-slot of the piece of a height, and the width of face A of the piece of a height, and the thing which specified the relation (W-t)/t of a flute width W and thickness t of a tabular fin proper, and it excels in the caulking workability and caulking state of a tabular fin, and a remarkable effect is done so on industry.

[Translation done.]

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] The (b) which shows the operation gestalt of the staking-die heat sink of this invention is [cross-section explanatory drawing at the time of caulking work and the (c) of cross-section explanatory drawing before a caulking and a (b)] cross-section explanatory drawings after a caulking.

[Drawing 2] It is tropia explanatory drawing of a heat sink.

[Drawing 3] A (b) is made to go away conventionally and flat-surface explanatory drawing before the caulking of a mold heat sink and a (b) are the a-a view views of a drawing (b).

[Description of Notations]

- 1 Substrate
- 2 Height
- 3 Slot
- 4 Tabular Fin
- 5 Wear Plate
- 6 Slot for Caulkings
- 7 Press Implement
- 8 Piece of Height

[Translation done.]

* NOTICES *

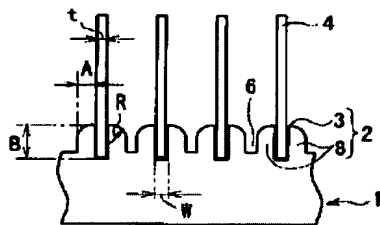
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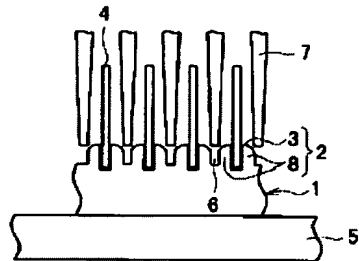
DRAWINGS

[Drawing 1]

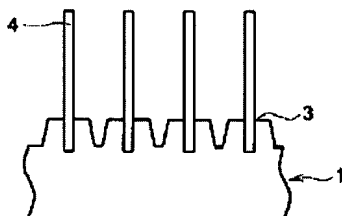
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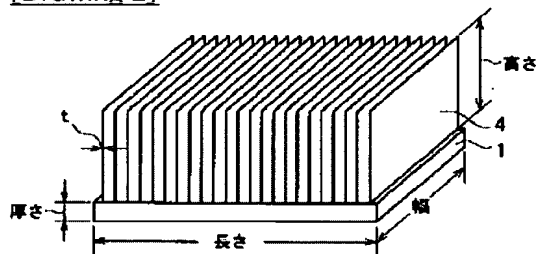
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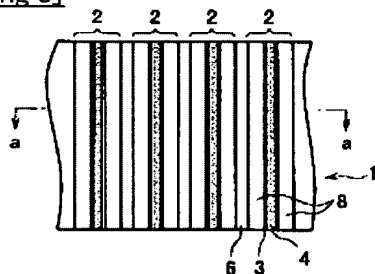


[Drawing 2]

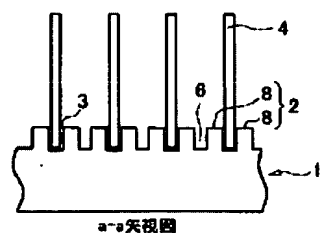


[Drawing 3]

(イ)



(ロ)



a-a 矢視図

[Translation done.]